Professor Joshua Lederberg

Department of Genetics

University of Wisconsin

Madison 6, Wisconsin

20 April, 1954

Dear Professor Lederberg:

I have received your reprints on 'transduction' for which I am exceedingly grateful. I am greatly interested in your papers, since I and My associates have been studying induction of antigenic changes in the structure of O antigens of Salmonella E_1, E_2 and E_x group, and have observed recently a phenomenan similar to transduction. As the details of the data have not been published as yet, important points are described in the enclosed papers.

I was thinking that you might be interested in the results of our experiments. I would appreciate your opinions and suggestions if I am not asking too much .

Yours sincerely,

H. Uetake

Hisao Uetake, M.D.
Professor
Department of Microbiology

It has been found that the organisms of Salmonella E_2 group are lysogenic and the bacteriophage obtained from them are capable of infecting the organisms of E_1 group. When the organisms of E_1 group were exposed to the phages, some of them were lysogenized and simultaneously, in lysogenized cells, their O antigens underwent a change from III,X to III,XV.

S.newington, S.selandia, S.new-brunswick, S.cambridge, S.kinshasa, S.canoga, and S.thomasville of E_2 group have been found to be lysogenic.

S.london, S.give, S.anatum, S.amager, S.zanzibar, S.shangani, S.batantan, S.vejle, S.meleagridis, S.elizabethville, S.simi, S.weltevreden and S.orion of E_1 group have all been found to be receptive to the phage and to be lysogenized, resulting in the antigenic changes from III,X to III,XV. O antigens of induced variants reverted to the original structure by cultivating the variant strains in broth containing XV antiserum, which was prepared by absorbing S.newington O antiserum with S.anatum.

In S.lexington and S.macallen, O antigens were changed from III,X to III,X,XV, which have not been observed as yet in naturally isolated Salmonella strains.

In S.chittagon O antigens were changed from I,III,X,XIX to III,XV, which reverted to I,III,X,XIX by cultivating the variant in broth containing XV antiserum, prepared as described above.

In S.niloese and S.senftenberg-simsbury, O antigens were altered by the phage from I,III,XIX to I,III,XIX,XV, which reverted to the original structure by cultivating the variants

in broth containing XV antiserum, prepared as described above.

In S.senftenberg 87Aa', which was a variant of S.senftenberg A and has only III as its major O antigen, O antigenic structure was converted from III to III,XV by the phage of S.canoga.

The above-mentioned findings indicate that strains of E_1 group or E_3 group can be lysogenized by infection with phage, which are obtained from lysogenic strains of E_2 group, and simultaneously their O antigenic structures are changed from III,X to III, XV or from I,III, XIX to I,III,XIX,XV and or in the special case of S. senftenberg 87Aa' from III to III,XV. It is noteworthy that the changes of O antigenic structure are always associated with lysogenization of the cultures. The induced variants, which contain XV antigenic factor as a part of O antigens, are invariably lysogenic and the phages obtained from them are capable of inducing the same antigenic variation in organisms of E_1 group as those from strains of E_2 group.

The activities inducing antigenic changes were not inactivated by desoxyribonuclease, but they were inactivated when the phages were inactivated.

These findings seem to be similar to Groman's findings on the relationship between toxigenicity and lysogenicity of Corynebacterium diphtheriae.

The followings are differences between your observations and ours.

1) You have observed that phage is not always transmitted to all the progeny of cells showing transduced character, but in

our experiments formation of XV antigenic factor is always associated with establishment of lysogenicity as far as tested.

2) In your experiments transducing lysates were prepared by adding phage 22 to a freshly seeded broth culture of the donor strain. In our experiments phage preparations were obtained by autolysis of cultures of E_2 group or by filtration of mixed broth cultures of E_1 and E_2 group cells. Even when phages were propagated on cells of E_1 group, they possessed activities inducing formation of XV antigenic factor. In so far as the formation of XV antigenic factor was concerned, the activity of the phage seemed not to be affected by strains on which phage was propagated.

3) In transduction you have pointed out replacements of genetic traits, while in our experiments there has been no evidence of such a replacement as yet.